Chapter Four

The Post-Archival Constellation: The Archive under the Technical Conditions of Computational Media

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In the present age, the archive is no longer hidden away in national libraries, museums, and darkened rooms, restricted in access and guarded by the modern-day equivalents of Jacques Derrida's *archons* – the guardians of the archive.[1] Indeed, researchers and archivists' hermeneutic right and competence – and the power to interpret the archives – have been transformed with digitalization and the new technics of computational surfaces. Through computation, access to archives is made possible and often welcomed – through rectangular screens that mediate the archives contents or through interfaces and visualizations that reanimate a previously inert collection. We might consider this not only a de-archiving of what we previously understood an archive to be but also as a creation of new archival forms through practices of re-archiving.[2] Indeed, Wolfgang Ernst argues that the original role of an archive was 'to preserve [...] for an indefinite time, or even to bar present access, conserving [...] for later, unexpected, and hence truly informational use'.[3] For Derrida, the 'gathering' of an archive was the 'dwelling in a location' and a place for objects and knowledge to be sheltered. It was a place of classification and putting into order a process of archivization.[4] Indeed, as he argued, 'archivable meaning is also and in advance codetermined by the structure that archives'.[5]

> This is another way of saying that the archive, as printing, writing, prosthesis, or hypomnesic technique in general is not only the place for stocking and for conserving an archivable content of the past which would exist in any case, such as, without the archive, one still believes it was or will have been. No, the technical structure of the archiving archive also determines the structure of the archivable content even in its very coming into existence and in its relationship to the future. The archivization produces as much as it records the event.[6]

The means by which an archive is produced *as* an archive through archival practices and materialities is a crucial aspect of the argument I want to make in this essay. However, the archival materialities and practices that

are generated and reinforced through computation raise important questions about how an archive is mediated when abstracted, delegated, or remapped through software. Archives still tend to preserve the physical record of their production but increasingly the notion of the archive has expanded to include metadata, catalogues, scholarly editions, databases, interfaces, and digital tools.[7] The archive, which is 'traditionally that which arrests time, which stops all motion, [instead] is set in motion in the age of digitization'.[8] In this chapter, I explore how the archive is increasingly linked to the notion of a diagram, such as a database, and how it is mediated through the computational interfaces and surfaces that set archives in motion. By examining the projective nature of computational processes, both in terms of the visibility of the remembered and the dark memory of the forgotten, this chapter explores how the post-archival constellation creates a generalized condition of forgetting. To make something computable requires that it be abstracted twice over: it must be encoded in a symbolic system of digital abstractions and captured in a grammar of actions that can be prescribed back onto physical activity. Abstraction is thus a feature of functionality: Philip E. Agre has argued that the less 'capture' that is operationalized in a computational system, the less functionality the system has. By capture, Agre indicates the process of acquiring data which is passed along to a database as well as the creation of an 'ontology' (or formal schema) that models a physical system.[9] These procedures are fundamental to the creation of a model of the underlying processes as well as the objectification of this model in the physical world. Procedures of abstraction make different knowledges comparable, calculable, and subject to re-engineering and reconstruction: they radically reshape the world in terms of the model that was originally abstracted and most likely in the shape of strategic-instrumental rationality.

Abstraction thus raises the possibility of a technical derangement of knowledge, practices, and artifacts, and it is from this perspective that I view the emergence of a new 'post-archival' constellation. I will tentatively trace the implications of abstraction for the concept of social memory and a new of social organization of knowledge. The archive is changed in the sense that it 'transmits the social bit by bit, transforming it technologically and becoming its key stimulus for evolution and industrial revolution'. Through its digital remediation it is put in a condition of performativity and, thereby, accelerated.[10] Thus, culture itself, understood as a kind of tertiary formation, is remade when materialized in a digital form.[11] By the post-archival, I am gesturing towards the notion of a 'post-digital' re-materialization of digital technology and its integration into physical environments but also the idea

of a historical phase of development that comes after the digital and changes the concept of the archive as a means of memory storage.[12]

A new dimension has been added to the archive, now that its velocities support not just storage but also innovation: the archive must 'erase information not only through economic reality but in order to be able to remember – even if delegation of "reading" to machines working at the speed of light allows for the sheer mass of memorisable material to be significantly increased'.[13] We are here confronted with a process in which the links between the contents of archives and their internal structure are increasingly lost or hidden, while a computerized ledger abstracts the archive from its representation. This changes the frameworks of social and individual memory – a fact that becomes manifest in epistemic communities that form around archives but which cannot always decode what is written or may even be overwhelmed by the sudden increase in archival materials previously subject to the constraints of access and storage. It also becomes manifest in the techniques and practices used in social reproduction such as teaching, learning, and specific literacies as well as in the problems of access that arise once memory is stored and transmitted in non-human readable forms. Could it be that the computational transformations in the structure and use of archives may act as a canary in the coalmine for wider changes in knowledge in society more generally?

To explore this question, I will first look at the idea of 'de-archiving' the archive through processes of computation. In the next section, I turn to the question of materialized abstractions and the way in which these abstractions mediate the archive through interfaces that function as a newly mobile resource. Finally, I draw these strands together to discuss the way in which these elements represent a new constellation, a post-archival situation that not only problematizes the very notion of a (relatively) static archive but that also sees computational opacity as the very ground of the archive's form and institutional structures.

De-archiving the archive

The traditional pre-digital structure of archives and practices of archivization were captured and stabilized through memory institutions such as museums, national libraries, universities, and national archives, often funded by the state. These institutions provided an organizational form and institutional structure that made possible a political economy for archives as such and hence an economic stability to the archive in question. Institutions provided

a decision-making centre around the collection of archives, in essence an institutionalized archivization process that delivered judgment in combination with curatorial functions. Indeed, the archive became 'defined as a given, preselected quantity of [artifacts] evaluated according to their worth for being handed down'.[14] The structure of traditional institutional arrangements around the archive was legitimated through a complex chain of practices and institutionalizations that authorized decisions to be taken about which parts of the present (and past) should be kept and what should be discarded.[15]

In contrast, in an age when digital technologies are delegated greater responsibility for a collection, computational rationalities are also increasingly granted the task of archiving and re-presenting materials: through computational analytics and user data, the archive creates a second-order archive.[16] This reflexive database (metadata) of the archive's use and motion can be used to fine-tune, curate, and prune the archive algorithmically, and in some cases also literally, in the sense of discarding artifacts that are not needed or which do not appear to have the cultural value initially expected. The ability of softwarized archives to make visible previously 'hidden' archives also serves as a justification for how an archive might be judged, such that 'increasingly, materials that are electronically inaccessible are simply not used'.[17] A paradox of digitality is the way in which its convenient surfaces serve to conceal that which is not digital.

We are indeed faced with new archival machines that demand not just a different social ontology but also different ways of exploring and interacting with archives. These new gateways to social memory are manifested in algorithms that instantiate a new archival imaginary – a post-archival constellation that is constantly modulated and 'augmediated'.[18] This is not a deterministic claim; rather, it requires the (re)building of new strata of organization that couple humans and non-humans in new and complex assemblies. As Christopher J. Prom argues, 'archivists should not treat [archival systems] as magic bullets. They will only prove to be effective in encouraging processing and descriptive efficiency if they are implemented as part of a strategic management effort to reformulate processing policies, processes, procedures.'[19] In Ernst's view, in 'the age of technology-driven media, both material archaeological strata and the symbolical order of the archive are progressively being conceived as essentially *processual* by nature'.[20] This processuality changes the way in which the archive functions, not least when it comes to selection: the quantification that comes with digitalization and the concomitant production of metadata feeds back into the qualitative judgments about what should be stored. This is often seen as a useful outcome of digitization, since the ability to track usage statistics,

etc. may lead to the development of precise qualitative and quantitative measures for the evaluation of special collections.

With the increasing interpenetration of computational systems and processes, we are thus witnessing a dramatic change in the material structure of memory institutions – in part due to technical changes but also due to the social ontologies that computational logic seems to produce. The digital creates a different kind of collection: digital archives are malleable and reconfigurable in multiple ways and do not necessarily need to conform to the organization structures and systems of traditional archives. The new archival management systems have been claimed to 'play a role in making archives more efficient and collections more visible',[21] yet the possibility of 'infinite archives' creates a new set of problems, particularly in born-digital and digitized collections where huge quantities of articles, texts, and data are suddenly made available. Now we are offered the possibility of generating comprehensive and exhaustive archives rather than curated ones.[22] Crucially, such archives are 'deeply computational in structure *and* content because the computational logic is entangled with the digital representations of physical objects, texts and "born digital" artifacts'.[23]

Computation therefore threatens to *de-archive* the archive, disintermediating the memory institutions and undermining the curatorial functions associated with archives. Many of the concerns of humanists have reflected an uncertainty about what the loss, or change, of archives might mean (although of course this could also reflect a loss of paper-based culture), especially where medial changes imply epistemic change.[24] Indeed, the logic of digitization implies that rather 'than being a purely read-only memory, new archives are successively generated according to current needs' – thanks to the use of computational searches, aggregations, collections, and application programming interfaces (APIs) that facilitate the interoperability and networking of archives.[25] In other words, digitization 'tends to move the archive toward an [informational] economy of circulation: permanent transformations and [constant] updating' which can also paradoxically result in a static archive of physical artifacts.[26]

To explore the assemblages that create the conditions under which computational systems are operative requires an understanding of the way in which algorithms structure not just knowledge but also space and time. Computational systems utilize feedback in the sense that they operate on their own algorithms and metadata to improve their processing, complexity, and structure. The fundamental programmability of computational media thus raises new questions for storing knowledge and culture: the archive 'is no longer simply a passive storage space but becomes generative itself

in algorithmically ruled processuality'.[27] Basic principles of computation – modularity, iteration, abstraction, optimization, etc. – are applied across the multiple levels of the computational system's operation. The question of the archive is therefore increasingly linked to new digital spaces and microtemporalities and the way in which they structure, organize, and mediate archival systems, institutions, and political economies.

In changing the structure of archives, and the memory institutions that curate and store them, computation renders them anew through a grammatization process that discretizes and re-orders. This process can be as simple as the infinitely re-orderable process of creating a database. It is also amenable to spatial planning and algorithmic analysis that presents the opportunity for a logic of objectification: through computational mediation, new approaches and methods are made objective and thereby instrumental. For example, the Internet is an archive that represents an open-ended 'aggregate of unpredictable texts, sounds, images, data, and programs' but that is nonetheless navigable and open to traditional archival practices. However, when the Internet is transformed into an archive, it is also subject to technologies such as search engines that make its commodification possible.[28]

It is this process of objectification that I am interested in. Here, I am using objectification in Adorno's sense of the term: taking the concept as the source of reconfiguration for the object or allowing the concept to require a reordering of the 'real' so that the real will conform to the concept.[29] Such objectification is what Adorno calls *identity thinking* – highly prevalent in a computational logic that tend towards strategic-instrumental forms of rationality. For Adorno, identity thinking is understood as a *style of thought* that subsumes particular objects under general concepts and as a result the particular is absorbed into the universal. Reality is abstracted and closed when we think we have succeeded in framing reality within our conceptual systems, which today are increasingly materialized in computational machinery. This is compounded by the reifications of commodity fetishism – that is, when social relations between people are transformed into or misunderstood as relations between things. The Frankfurt School instead provided a model of the relationship between social processes, social institutions, and consciousness by providing a sociological explanation of the socially determined yet relative autonomous emergence of new social forms. Such an approach critiques a political economy that automatically assumes the economic determination of the social and the cultural. It asks us, rather, to examine the way in which, for example, a phenomenon such as social memory might be crucial for explaining the emergence of certain social formations and the processes of capitalism more generally.

In other words, computation recasts the material world into the shapes dictated by computational analysis or computational processes in a process of objectification. With archives, the first move has been upon us for a while, observable in large-scale digitalization projects (sometimes understood as digital humanities type projects) and in the use of encoded archival description (EAD) software and standards.[30] Following this initial process, with its emphasis on the digital overlay or mediation of the artifact, new techniques of control and management become possible such as re-ordering, searching, discovery, optimization. New tools of analytics, data visualization, dashboards, and information management systems are then often deployed to examine the previously latent forces of the archive. Indeed, 'the archive as the condition for our knowledge of history becomes dependent on the media of its transmission', which is increasingly mediated by computation forms.[31]

Digitalization puts pressure on the need for the storage of originals, and many objects are sent off to less-expensive locations far from the centres of population. But it also raises the question of the need for originals as, sooner or later, the access or footfall (which is tracked) shows a declining access rate for the original materials. In some cases, the digital versions are considered superior to the originals due to the quality and resolution of the scanning processes. New digital formats also present the materials in new interfaces such as PDFs, HTML5, ePUB, and other storage formats. Some of these are remarkably plastic compared with the original materials and also amenable to computational self-analysis – reinforcing the move towards a logic of distant reading. This derangement in the organization of knowledge is critical to the functioning of computation but potentially at the cost of human intelligibility.

To the extent that social memory is understood as an artifact of the organization of media, the entire process outlines a new modality in our engagement with culture. Such a perspective gets support from Bernard Stiegler's idea of *tertiary memory* as a site of materialized memory beyond the human brain. The question of storage is transformed by the computational: most notably when the long memory chains of temporally connected artifacts that are stored by institutions and media are rebuilt around the requirement of short memory chains that are continually refreshed and updated. These procedures are not always human-readable, nor human-centric. For example, in Amazon's equivalent of an archive, multiple objects are packed tightly into a warehouse space that is computationally managed through a technology stack.[32] Here I am interested in the spatial dimension of reorganization through computational processes – more developed in capitalist warehousing systems but also reflected in library and archive storage facilities that have

the same pressures on cost, labour, and funding. Amazon uses a principle of simplicity and an idea of 'flatness' to create a computational archive of physical objects. All objects are treated as records to be entered into a database, and they are processed through a grammatization framework which flattens the object not only into the data store but also within the warehouse space: the singularity of the object is, in other words, abstracted away by the technology. Objects are retrieved using computer-controlled robots from Kiva Systems, which glide swiftly and quietly around the warehouse. To do this, Amazon uses a so-called 'chaotic storage' algorithm that optimizes storage through mediating databases. For example, if Amazon receives a shipment of 500 copies of a specific book, they do not store the 500 copies together in one location. Rather, they distribute the books to different areas of empty shelf space across the warehouse and record the locations in the database through barcodes on the shelves and on the objects. This is very different from human-centric notions of archival cataloguing and organization, where one tends to group similar items together.

This storage and optimization is done computationally: Amazon knows the exact dimensions of every product in its warehouses and the exact dimensions of vacant shelf space. The robots glide the objects to be stored to the most efficient places. This is reminiscent of Ernst's claim that the Internet itself adopts a similar chaotic storage method – an anarcho-archive – such that so much information today is 'chaotically shelved – leading to archival phantasms of disorder'.[33] From the outside, the Amazon system looks horribly disorganized and illogical. In fact, the warehouse represents the *objectification of the chaotic storage algorithm*. It is constructed with the logic of objectification such that due to the computational mappings that technology makes possible, neither the range of artifacts to be archived as a whole nor the number of particular artifacts need to be known or planned in advance. The warehouse is in effect a reification of the code into the materials of stone, metal, plastic, and human labour.[34] The system functions at the highest rates of efficiency in the retail industry and relies on humans being separated from the act of stowing things and relegated to the role of 'picking' objects as dictated by the computational system. Storage capacity and its cartographies of space are delegated to algorithms.

Materialized abstractions

In order to explore these changes, we need an approach that can map the multiple levels of activity and complexity that computation creates.

Additionally, it is important that the principle of irreducibility is brought to bear on the problem of computation. If not, we fetishize silicon rather than giving attention to the appropriate abstraction layer – crucially the *materialized abstraction*. In *Critical Theory and the Digital* (2014), I undertook some of this preparatory work by developing an implicit understanding of the way in which abstraction layers functions within the design, implementation, and execution of computational systems more generally such that software becomes 'deep'.[35] I want to briefly summarize this typology to provide a number of abstraction layers that can serve as a means of analyzing the materialized digital. The aim is to ensure that analysis takes place at the right level of abstraction: one should take into account the principles of computational thinking that takes place in that layer yet still be able to drill deeper into the computational framework if required.

A useful way of exploring how computation is expressed across multiple layers is through the heuristic notion of a *laminated system*. By laminated system, I am referring to the work of Roy Bhaskar who uses this notion to draw our attention to the problem of the levels of ontology when studying things. This approach can help us 'develop a language for understanding and describing our object(s) of study at an "appropriate" ontological level'.[36] However, as this approach tends to present an unnecessarily static model that misses the interaction and interoperability between layers in software implementation, it may be better to understand these layers as elements in a constellation of technologies that make up the technology 'stack'. Adorno argues that one must create constellations by 'assembling the whole out of a series of partial complexes that are, so to speak, of equal weight, and concentrically arranged on the same level; their constellation, not their succession must yield the idea'.[37] By the term 'stack', I am referring to the way in which technologies are brought together to create computer systems such that they build upon each other and create a vertical stack of technologies. For example, one stack might include the operating system, the database technology, the middle-ware, and the applications. The specifics of the technical implementation, such as GNU/Linux, MySQL, node.js, and Chrome indicates one specific example of the materialized technical stack, whereas Microsoft Windows, SQL server, .net, and Internet Explorer gives another.[38] It is, however, crucial to understand that these technologies do not need to form such a vertical structure and may also be organized in a more open-ended horizontal or rhizomatic structure; hence the attraction of the notion of constellation.

A stack constellation contains six key moments: (i) *physical*: the material and transactional level (of the hardware), (ii) *logical*: the logical, network,

Individuational	Stratification of embodied personality (the psychology of actors, the user, etc.).
Logistical	Social and organizational structure (at the level of institutions, economies, culture, etc.), social ontology, socialities, etc.
Interactional	Surface/interface level (between human beings and non-humans mediated through code)
Codal	Textual and coding logics (level of code, algorithms, software as text and/or process)
Logical	The logical, network and informational transactional level (level of software as diagram or platform)
Physical	Material and transactional level (of the hardware)

Fig. 4.1: Computation expressed across multiple levels through a heuristic notion of a laminated system (See Berry, 2014, p. 58).

and informational transactional level (level of software as diagram or platform), (iii) *codal*: the textual and coding logics (level of code, algorithms, software as text and/or process), (iv) *logistical*: the social and organizational structure (at the level of institutions, economies, culture, etc.), social ontology, socialities, etc., (v) *individuational*: the stratification of embodied personality (the psychology of actors, the user, etc.), (vi) *interactional*: the surface/interface level (between human beings and non-humans mediated through code). The moments presented here are ideal types and may simply help us understand the complexity and composition of computational systems. Each moment has to be explicitly designed, implemented, and structured within the computational system under construction – they require (often hidden) work to bring them together and ensure they function as a system. Due to the modularity of computational systems, however, it is not necessary to build from scratch for each system. Indeed, many layers are now available as software services that allow for the majority of these levels to be bought off the shelf, accelerating the development of stack-based systems.

Due to limitations of space, I am going to focus on only one of the moments mentioned above – the interactional in relation to the post-archival

constellation.[39] I have chosen to focus on the interactional in order to highlight the problematics of the interface and the surface. I particularly want to shed light on what has grown to be called *design thinking*; the idea that design is embedded in all aspects of production rather than being an ornamental or final stage of a process.[40] This wider notion of design was articulated by Buchanan as 'the conception and planning of the artificial' points to the inherent multidisciplinary nature of design work and the complexity of communications across multiple fields of knowledge.[41] It also points to the idea of *deep design* that is increasingly informing the design thinking that goes into computational systems and which means that the interface as a material and conceptual system influences and determines decisions made in the design and implementation of the archival system.

In the post-archival constellation, we see the application of certain logics of computation in the interactional moment itself. This is located in the organization of knowledge but also in its display, interactivity, and so forth. Here, I want to explore two competing metaphors which become obdurate in the interactional interface designs that are selected in particular design grammars. My argument is by nature speculative due to the fact that many archival management systems predate the new design grammars that are emerging within the design and technology fields. However, the speed at which these paradigms are taking hold of the models of interface design in computing will inevitably push on the archival systems, at first as an abstraction away from the legacy systems that are based on relational databases and textual screens until their 'simple' design philosophies begin to penetrate the underlying codal and logistical levels of these systems.[42]

The two systems I want to focus on are Apple's new design grammar, which has become known as 'flat design', and Google's competitor design grammar called 'material design'. I focus on these firstly because they are increasingly hegemonic interactional patterns, and secondly because their organization and logic bear their computational origins in their visualization, etc. As we increasingly read archives computationally, these display metaphors – foregrounding simplicity, minimalism, and lightweight approaches to complexity – structure the way in which knowledge is presented and manipulated.

These two new competing interface paradigms are deployed in the latest version of Apple and Google's operating systems but more notably as regulatory structures to guide the design and strategy related to corporate policy. The first, 'flat design', was introduced by Apple through iOS 7/8 and OS X Yosemite as a refresh of the ageing operating systems' human/computer interface guidelines. The strategy was essentially that stripping

the operating systems of historical baggage related to design techniques intended to disguise the limitations of a previous generation of technology both in terms of screen resolution and processor capacity. For example, visual interfaces would use techniques such as anti-aliasing to deceive the eye into thinking a higher resolution was being shown than technically possible – mainly through the careful use of light and shadow. The second, the 'material design' introduced by Google in its Android L, now Lollipop, operating system, also sought to bring some sense of coherence to a multiplicity of Android devices, interfaces, OEMs, and design strategies.

It is, however, important to note that Apple avoids talking about 'flat design' as its design methodology, preferring to talk in terms of platform specificity, that is, about iOS's design or OS X's design. More generally, 'flat design' is 'the term given to the style of design in which elements lose all the stylistic characters that make them appear as though they lift off the page'.[43] As Apple argues, one should 'reconsider visual indicators of physicality and realism' and think of the user interface as 'play[ing] a supporting role': the idea is that techniques of mediation in the user interface should aim to provide a new kind of computational realism, presenting 'content' as ontologically prior to, or separate from, its container in the interface.[44] This approach contrasts with rich design, which has been described as 'adding design ornaments such as bevels, reflections, drop shadows, and gradients'.[45]

I want to explore these two main paradigms – while acknowledging the flat-design methodology initiated as 'Metro' in Windows 7 and the (since renamed) 'Microsoft Modern' interface – by looking at Apple and Google's comprehensive attempt to produce a rich and diverse *umwelt* or ecology, linked through what Apple calls 'aesthetic integrity'.[46] The attempt is a response to a growing landscape of devices, platforms, systems, apps, and policies but also aims to provide a sense of operational strategy in relation to computational imaginaries. Essentially, both approaches share an axiomatic approach to the construction of a thought system, reflecting a primitivist predisposition that draws from a neo-Euclidian model of geons (such as circles, triangles, and polygons for Apple), as well as notions of intrinsic value or neo-materialist emphasis on essential characteristics (such as shadow cast from objects for Google). Such approaches then encapsulate what I think of as *flat theory*. Both Apple and Google are trying to deal with the problematic of multiplicities in computation and the requirement that multiple data streams, notifications, and practices have to be combined and managed within the limited geography of the screen. In other words, both approaches attempt to create what we might call aggregate interfaces by combining techniques of layout, montage, and collage onto computational surfaces.[47]

The 'flat turn' has not happened in a vacuum, however, and is the result of a new generation of computational hardware, smart silicon design, and retina screen technologies. This has been driven in large part by the mobile device revolution which has not only transformed the taken-for-granted assumptions of historical computer interface design paradigms (e.g. WIMP) but also the subject position of the user, in particular as structured through the Xerox/Apple concept of single-click functional design of the interface. Indeed, one of the striking features of the new paradigm of flat design is that its design philosophy is geared towards multiplicity and multi-events. The flat turn is about modulation, not enclosure: it is a processual form that constantly shifts and changes and that could be seen to act as a signpost for future real-time algorithmic and adaptive surfaces and experiences. It is easy to see how the language of flows and interactivity might be seductive to archivists seeking to make their archives more interesting, relevant, and mobile. Indeed, the structure of control for the flat design interfaces could be said to follow that of the control society in the sense that it is 'short-term and [with] rapid rates of turnover, but also continuous and without limit'.[48] To paraphrase Gilles Deleuze, humans are no longer in enclosures, certainly, but everywhere humans are in layers.

Apple uses a series of concepts to explain a notion of flat design that includes aesthetic integrity, consistency, direct manipulation, feedback, metaphor, and user control.[49] Reinforcing the haptic experience of this new flat user interface has been described as building on the experience of 'touching glass' in order to develop the 'first post-Retina (Display) UI (user interface)'.[50] The concept is based on the idea of layered transparency, or better, layers of glass upon which the interface elements are painted through a logical internal structure of Z-axis layers. This laminate structure enables meaning to be conveyed through the organization of the Z-axis, both in terms of content and in terms of its place within a process or the user interface system itself.

In a similar way, Google has reorganized its computational imaginary around a flattened, layered representational paradigm centred on the concept of *material design*. Matias Duarte, Google's Vice President of Design, has declared that this approach is based on the notion that it 'is a sufficiently advanced form of paper as to be indistinguishable from magic'.[51] However, it is magic that has constraints and affordances built into it, since 'if there were no constraints, it's not design – it's art'.[52] Indeed, Google argues that the 'material metaphor is the unifying theory of a rationalized space and a system of motion':

> The fundamentals of light, surface, and movement are key to conveying how objects move, interact, and exist in space and in relation to each other. Realistic lighting shows seams, divides space, and indicates moving parts... Motion respects and reinforces the user as the prime mover... [and together] they create hierarchy, meaning, and focus.[53]

This is a weird notion materiality in as much as those at Google

> steadfastly refuse to name the new fictional material, a decision that simultaneously gives them more flexibility and adds a level of metaphysical mysticism to the substance. That's also important because while this material follows some physical rules, it doesn't fall into the techniques of skeuomorphism, which represented digital interfaces as if they were similar to physical objects. For example, an audio recorder might look like an old tape player in the interface to help communicate the affordance or functionality of a design element. The material isn't a one-to-one imitation of physical paper, but instead it's 'magical'.[54]

Google emphasizes this connection, arguing that 'in material design, every pixel drawn by an application resides on a sheet of paper. Paper has a flat background colour and can be sized to serve a variety of purposes. A typical layout is composed of multiple sheets of paper'.[55] The stress on material affordances – paper for Google and glass for Apple – are crucial to understanding their respective stances in relation to flat design philosophy.

> **glass (Apple)**: translucency, transparency, opaqueness, limpidity and pellucidity.
> **paper (Google)**: opaque, cards, slides, surfaces, tangibility, texture, lighted, casting shadows.[56]

In contrast to the layers of glass that inform the logics of transparency, opaqueness, and translucency in Apple's flat design, Google uses the notion of paper remediated as a digital material, since this 'material environment is a 3D space, which means all objects have x, y, and z dimensions. The z-axis is perpendicularly aligned to the plane of the display, with the positive z-axis extending towards the viewer. Every sheet of material occupies a single position along the z-axis and has a standard 1dp thickness.'[57] One might think then of Apple's design as painting on layers of glass and Google's design as thin paper objects placed upon background paper. However, a key difference lies in Google's use of light and shadow, so that a light source, located in a

similar position to the user of the interface, may produce shadows of the paper objects onto the objects and sheets of paper that lie beneath them.[58] Nonetheless, a laminate structure is key to the representational grammar that constitutes both of these platforms.

Interestingly, both design strategies emerge from an engagement with, and reconfiguration of, the underlying principles of the Swiss style in design, sometimes called the International Typographic Style.[59] This approach emerged in the 1940s, and

> mainly focused on the use of grids, sans-serif typography, and clean hierarchy of content and layout. During the 40s and 50s, Swiss design often included a combination of a very large photograph with simple and minimal typography.[60]

The design grammar of the Swiss style has been combined with minimalism and the principle of 'responsive design', placing emphasis on the fact that the materiality and specificity of the device should be responsive to the interface and context being displayed.[61] Minimalism is a 'term used in the 20th century, in particular from the 1960s, to describe a style characterized by an impersonal austerity, plain geometric configurations and industrially processed materials'.[62] Robert Morris, one of the artists associated with this tendency and author of the influential *Notes on Sculpture,* used 'simple, regular and irregular polyhedrons, influenced by theories in psychology and phenomenology' which he argued 'established in the mind of the beholder "strong gestalt sensation", whereby form and shape could be grasped intuitively'.[63]

The implications of Apple and Google's competing design worldviews are far-reaching in that much of the world's initial contact, or touch points, for data services, real-time streams, and computational power flows through the platforms controlled by these two companies.[64] In addition, they are also deeply influential across the programming industries, and we see alternatives and multiple reconfigurations emerging in response to the challenge raised by the 'flattened' design paradigms. In other words, both represent, if only *in potentia*, a form of power that places a particular ideological veneer on computation more generally. With the proliferation of computational devices and their associated screenic imaginary, a new logic appears that underpins, justifies, and legitimates these design methodologies.

It therefore seems to me that these new flat design philosophies produce an order of precepts and concepts that gives meaning and purpose not only to interactions with computational platforms but also, more widely,

to everyday life. Flat design and material design are philosophies that offer alternative patterns of creation and interpretation: they are meant to have an impact not only on interface design but also on the practices and the experiences of computational technologies more broadly conceived. One could think of these moves as a computational foundation that generates or provides arguments for an axial framework of building, reconfiguration, and preservation.

As an instance of the materialization of the interactional in the post-archival constellation, the analysis of flat design helps us examine the

> history locked in the object [...] mindful of the historic positional value of the object in its relation to other objects – by the actualization and concentration of something which is already known and transformed by that knowledge. Cognition of the object in its constellation is cognition of the process stored in the object. As a constellation, theoretical thought circles the mode of thinking it would like to unseal, hoping that it may fly open like the lock of a well-guarded safe deposit box, in response, not to a single key or a single number, but to a combination of numbers.[65]

Focus on stack constellations go beyond the specificity of the device as privileged site of research and reorient critical attention toward the complex computational layers that constitute them. For example, interface techniques are abstracted away from the specificity of the device, for example through Apple's 'handoff' continuity framework, which also potentially changes reading and writing practices in interesting ways.[66]

These new interface paradigms, introduced by the flat turn, have very interesting possibilities for the application of interface criticism and allow us to unpack and explore the major trends and practices of 'the Stacks'. 'The Stacks' are my term for the corporations that increasingly rely on computational technology stacks for profit and power such as Google, Apple, Facebook, and Amazon (sometimes called GAFA) – but also the technical imaginary formed through the diagrammatics of stacks. By diagram, I am indicating an abstraction speculatively determining the future: Wolfgang Ernst uses the term to highlight the generative dimensions of technical diagram, which may also be understood as a modality of power.[67] The notion of layers are instrumental when trying to mediate the experience of an increasingly algorithmic society (think dashboards, personal information systems, the quantified self, etc.): it may provide an interpretative framework for a world of computational patterns in addition to constituting a grammar for building such systems in the first place. The

concept of the post-digital may perhaps be useful when questioning the link between archives, computation, and knowledge given here.[68] Yet the concepts of materiality deployed by archivists working within flat design and material design paradigms – whether of paper, glass, or some other 'material' substance –are even more important for our understanding of these systems and their relationship with social memory.[69]

Flat design provides and more importantly serves as a translational or metaphorical heuristic for re-presenting the computational, but it also teaches consumers and users how to use and manipulate new complex computational systems and stacks. Thanks to a striking visual technique, flat design communicates the laminate structure of the computational stack on which the Stack corporations are themselves constituted. In this organization, history is indeed locked within the object.

In an age in which archives become computational, they are themselves subject to the frequent rearrangements and reconfigurations of a new medium of inscription and new sites of control. The question of how these computational paradigms connect to the archive itself remains a key critical question and one that must be distinguished from the perspectives of technological determinism. Principles of instrumentality are embedded not only in computational systems but also in a neoliberal order that legitimates through principles of performativity, efficiency, and a political economy of value and that forces the archive to conform and interoperate. It is here, crucially, that the humanities must learn to provide critical approaches that contest and make visible archival systems and their embedded logics.

The post-archival constellation

One way of thinking about computational archives and new forms of abstraction they produce is the specific ways in which they manage the 'derangement' of knowledge through distance.[70] I can only gesture towards this derangement by way of the theological concept of the coincidence of the opposites that 'comprehends all else in undifferentiated and unlimited unity'[71] – the notion that, from the standpoint of infinity, all difference is reconciled (in contrast to the dialectical notion of *aufhebung*). This is similar to the notion of the aesthetics of singularity that Fredric Jameson describes as particular to postmodernity.[72] Flat design could, for instance, be said to place the user-subject in a similar position of infinity/singularity: it enables the reconciliation of multiple fragments not by having one element replacing all the others but rather by using a metaphor, such as

glass, in order to allow palimpsest-like inscriptions to be stacked in an infinitely thin laminate of computational surface. This particular technique of ordering extends to many aspects of computational design that facilitates the collection of diverse objects as well as their ordering, calculation, and reconfiguration. As Derrida argued, archival technology 'conditions not only the form or the structure which prints, but the printed content of the printing: the pressure of the printing, the impression, before the division between the printed and the printer. [It] has commanded that which even in the past instituted and constituted whatever there was as anticipation of the future.'[73] Indeed, through the new modes of computational ordering, a new de-archived archive emerges, one that is tightly coupled to information systems and instrumental principles of making things 'stand by'.[74]

Notes

1. Derrida, p. 10.
2. By de-archiving, I am gesturing towards the transformation of the archive from a static space into one that is informed and interpenetrated by computation that restructures space through formatting, structuring, and classification. We should also note that archives can be multi-layered and their structural organization may have deeper and shallower forms of archive. That is, that some artifacts may be more amenable to access than others, and there may be archives within archives which may require access and order codes before they are available. However, even so, computation reaches into the depths of all archives, and in doing so reorganizes knowledge, artifacts, objects, and systems on the principle of computational knowledge.
3. Ernst, 2013, p. 93.
4. Derrida, p. 11.
5. Ibid., p. 18.
6. Ibid., p. 17.
7. Palmer, p. 404.
8. Røssaak, p. 12.
9. Agre, p. 744.
10. Stiegler, 2010, p. 151.
11. Stiegler, 2008, p. 42.
12. See Taffel for a useful discussion of the notion of the postdigital.
13. Stiegler, 2008, p. 128.
14. Ernst, 2013, p. 86
15. Ibid., p. 122.
16. Archives would previously have had a second-order documenting system associated with it, but it would have been paper-based and not subject

to the same degree of calculability of a digital records system or archival management system.

17. Jones, quoted in Spiro, p. 2.
18. For a discussion of the concept of augmediation, see Mann.
19. Prom, quoted in Spiro, p. 5.
20. Ernst, 2013, p. 27.
21. Archival management systems are a kind of software that typically provide integrated support for the archival workflow, including appraisal, accessioning, description, arrangement, publication of finding aids, collection management, and preservation. See Spiro, p. 1.
22. Berry, 2012, p. 2.
23. Ibid., p. 13.
24. By 'paper-ish', I am gesturing towards Eisenstein's notion of 'bookish' culture, Eisenstein, p. 10.
25. Ernst, 2013, p. 81.
26. Ibid., p. 99. But see also the documentary film *Cold Storage,* co-written by Jeffrey Schnapp and Matthew Battles, which explores Harvard Depository, Harvard's off-site library storage facility. *Cold Storage* (1991) Directed by Cristoforo Magliozzi [Film], USA: metaLab at Harvard, available from http://librarybeyondthebook.org/cold_storage.
27. Ernst, 2013, p. 29
28. Ibid., p. 29
29. Berry, 2014, p. 102.
30. Berry, 2012. Encoded archival description (EAD) is an XML-based standard for representing archival finding aids, which describe archival collections. EAD allows the standardization of collection information in finding aids within and across repositories.
31. Ernst, 2013, p. 42
32. Greenfield.
33. Ernst, 2006, p. 120.
34. Kitchin refers to this process as 'transduction'.
35. Berry, 2014.
36. Ibid., p. 58.
37. Adorno, 1977, p. 126.
38. Terranova offers a political reading of the importance of the notion of the technology stack and the possibility for contestation in the shaping of these stack-based structures.
39. Although the interactional is the focus of this chapter, it is clear that the protocols and standards (codal level) around archival systems, such as the encoded archival description software, would also be a productive site for further critical analysis.
40. See Rowe.
41. Buchanan, p. 14.

42. There are already abstraction layers and technologies that present the underlying data or archive in a form more conducive to the simplicity and speed demanded by flat design, for example node.js, MongoDB, Cassandra, redis, and the JSON data format. In many ways, flat design can be seen as the natural outcome of the performative requirements of complex network systems that require simple axiomatic protocols, data formats, communications channels, abstraction layers, and modularities to enable them to be built rapidly. What is new and interesting in relation to flat design is the underlying material metaphor for the components, e.g. glass or paper.
43. Turner, 2014.
44. Apple, 2014.
45. Turner, 2014.
46. Apple, 2014.
47. Berry, 2014, p. 70.
48. Deleuze, p. 6.
49. Apple, 2014.
50. Cava, 2013.
51. Bohn, 2014.
52. Ibid.
53. Google, 2014.
54. Bohn, 2014.
55. Google Layout, 2014.
56. The choice of paper and glass as the founding metaphors for the flat design philosophies of Google and Apple raise interesting questions for the way in which these companies articulate the remediation of other media forms such as books, magazines, newspapers, music, television, and film. Indeed, the very idea of 'publication' and the material carrier for the notion of publication is informed by the materiality, even if only a notional affordance given by this conceptualization. It would be interesting to see how the book is remediated through each of the design philosophies that inform both companies, for example.
57. Google, 2014.
58. Jitkoff, 2014.
59. Ashghar, 2014; Turner, 2014. One is struck by the posters produced in the Swiss style that date to the 1950s and 60s but which today remind one of the mobile device screens of the twenty-first century.
60. Turner, 2014.
61. For an example, see Bootstrap, 2015.
62. MoMA, 2014.
63. Ina Blom has pointed out 'there are contradictory 'effects' of minimalism and the Gestalt theory of influence in Morris's early work is only one aspect of the minimalist legacy in art—the phenomenological dimension of minimalism (also explored in Morris's writing) produces a rudimentary form of context awareness in the spectator, who is confronted with him/herself

given the minimal work's absence of internal relations or tensions. Minimalism thus initiates the type of awareness that produced phenomena such as institution critique in art, site-specific art, 'context art', etc.' For more on the topic, see Foster, p. 35-70.

64. MoMA, 2014. There are also some interesting links to be explored between the Superflat style and the postmodern art movement founded by the artist Takashi Murakami that is influenced by manga and anime, both in terms of the aesthetic but also in relation to the cultural moment in which 'flatness' is linked to 'shallow emptiness' (see Drohojowska-Philp, 2001).
65. Adorno, 1973, p. 163.
66. Hattersley, 2014.
67. See Parikka, 2011.
68. Berry and Dieter, 2015.
69. There is some interesting work to be done in thinking about the non-visual aspects of flat theory, such as the increasing use of APIs, such as the RESTful api, but also sound interfaces that use 'flat' sound to indicate spatiality in terms of interface or interaction design.
70. By distance, I am thinking in terms of near and far.
71. Stanford, 2013.
72. Jameson, 2015.
73. Derrida, p. 18.
74. Heidegger, 1977.

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